

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended) A method for analyzing fundamental frequency information contained in voice samples, ~~characterized in that it comprises at least~~ comprising:

- in a computer processing a step (2) for the analysis of the voice samples grouped together in frames in order to obtain, for each sample frame, information relating to the spectral envelope and information relating to the fundamental frequency;

- a step (20) for the determination of a model representing the common characteristics of the spectral envelope and fundamental frequency of all said voice samples; and

- a step (30) for determining a prediction function for predicting the fundamental frequency according exclusively to said information relating to the spectral envelope on the basis of said model and voice samples.

2. (currently amended) The method as claimed in claim 1, ~~characterized in that~~ wherein said analysis step (2) is adapted to supply said spectrum-related information in the form of cepstral coefficients.

3. (currently amended) The method as claimed in claim 1, ~~characterized in that~~ wherein said analysis step (2) comprises:

- a sub-step (4) for modeling voice samples according to a sum of a harmonic signal and a noise signal;
- a sub-step (5) for estimating frequency parameters, and at least the fundamental frequency of the voice samples;
- a sub-step (6) for synchronized analysis of the fundamental frequency of each sample frame; and
- a sub-step (7) for estimating the spectral parameters of each sample frame.

4. (currently amended) The method as claimed in claim 1, ~~characterized in that~~ wherein it furthermore comprises a step (10) for normalizing the fundamental frequency of each sample frame in relation to the mean of the fundamental frequencies of the analyzed samples.

5. (currently amended) The method as claimed in claim 1, ~~characterized in that~~ wherein said step (20) for the determination of a model corresponds to the determination of a model by mixing Gaussian densities.

6. (currently amended) The method as claimed in claim 5, ~~characterized in that~~ wherein said model determination step (20) comprises:

- a sub-step (22) for determining a model corresponding to a mixture of Gaussian densities; and

- a sub-step (24) for estimating the parameters of the mixture of Gaussian densities on the basis of the estimation of the maximum resemblance between the information relating to the spectral envelope and the fundamental frequency information of the samples and of the model.

7. (currently amended) The method as claimed in claim 1, ~~characterized in that~~ wherein said step (30) for the determination of a prediction function is implemented on the basis of an estimator of the implementation of the fundamental frequency, knowing the information relating to the spectral envelope of the samples.

8. (currently amended) The method as claimed in claim 7, ~~characterized in that~~ wherein said step (30) for determining the fundamental frequency prediction function comprises a sub-step (32) for determining the conditional expectation of the implementation of the fundamental frequency, knowing the information relating to the spectral envelope, on the basis of the a posteriori probability that the information relating to the spectral envelope is obtained on the basis of the model, the conditional expectation forming said estimator.

9. (currently amended) A method for the conversion of a voice signal pronounced by a source speaker into a converted voice signal whose characteristics resemble those of a target speaker, comprising at least:

- in a computer processing a step (50) for determining a function for the transformation of characteristics of the spectral envelope of the source speaker into characteristics of the spectral envelope of the target speaker, implemented on the basis of voice samples of the source speaker and the target speaker; and

- a step (70) for transforming characteristics of the spectral envelope of the voice signal of the source speaker to be converted with the aid of said transformation function,

wherein the method ~~characterized in that it furthermore~~  
further comprises:

- a step (60) for determining a prediction function for predicting a fundamental frequency exclusively according to information relating to the spectral envelope for the target speaker, said prediction function being obtained according to the method of claim 1; and

- a step (80) for predicting the fundamental frequency of the voice signal to be converted by applying said fundamental frequency prediction function to said transformed characteristics of the spectral envelope of the voice signal of the source speaker.

10. (currently amended) The method as claimed in claim 9, ~~characterized in that~~ wherein said step (50) for determining a transformation function is implemented on the basis of an estimator of the implementation of the target spectral characteristics, knowing the source spectral characteristics.

11. (currently amended) The method as claimed in claim 10, ~~characterized in that~~ wherein said step (50) for determining a transformation function comprises:

- a sub-step (52) for modeling the source and target voice samples according to a sum model of a harmonic signal and a noise signal;

- a sub-step (54) for aligning the source and target samples; and

- a sub-step (56) for determining said transformation function on the basis of the calculation of the conditional expectation of the implementation of the target spectral characteristics, knowing the implementation of the source spectral characterizations, the conditional expectation forming said estimator.

12. (currently amended) The method as claimed in claim 9, ~~characterized in that~~ wherein said transformation function is a spectral envelope transformation function.

13. (currently amended) The method as claimed in claim 9, ~~characterized in that it furthermore~~ wherein the method further comprises a step (65) for analyzing the voice signal to be converted, adapted to supply said spectrum-related information and information relating to the fundamental frequency.

14. (currently amended) The method as claimed in claim 9, ~~characterized in that it furthermore~~ wherein the method further comprises a synthesis step (90), enabling the formation of a converted voice signal at least on the basis of the transformed characteristics of the spectral envelope and the predicted fundamental frequency information.

15. (currently amended) A system for converting a voice signal (110) pronounced by a source speaker into a converted voice signal (120) whose characteristics resemble those of a target speaker, said system comprising ~~at least~~:

- a computer, the computer programmed to process:

- means (104) for determining a function for transforming characteristics of the spectral envelope of the source speaker into characteristics of the spectral envelope of the target speaker, receiving, at their input, voice signals of the source speaker (100) and of the target speaker (102); and

- means (114) for transforming characteristics of the spectral envelope of the voice signal (110) of the source speaker to be converted by applying said transformation function supplied by the means (104),

~~characterized in that it furthermore~~ wherein the system further comprises:

- means (106) for determining a prediction function for predicting a fundamental frequency exclusively according to information relating to the spectral envelope for the target speaker, adapted for the implementation of an analysis method as claimed in claim 1, on the basis of voice samples (102) of the target speaker; and

- means (116) for predicting the fundamental frequency of said voice signal to be converted (110) by applying said prediction function determined by said means (106) for determining a prediction function to said transformed characteristics of the spectral envelope supplied by said transformation means (114).

16. (currently amended) The system as claimed in claim 15, ~~characterized in that it furthermore~~ further comprises:

- means (112) for analyzing the voice signal to be converted (110), adapted to supply, at their output, spectrum-related information and information relating to the fundamental frequency of the voice signal to be converted; and

- synthesis means (118) enabling the formation of a converted voice signal on the basis of at least the transformed characteristics of the spectral envelope supplied by the means (114) and the predicted fundamental frequency information supplied by the means (116).

17. (currently amended) The system as claimed in claim 15, ~~characterized in that~~ wherein said means (104) for determining a transformation function are adapted to supply a spectral envelope transformation function.



18. (currently amended) The system as claimed in claim 15, ~~characterized in that it~~ wherein the system is adapted for the implementation of a voice conversion method comprising:

- a step (50) for determining a function for the transformation of spectral characteristics of the source speaker into spectral characteristics of the target speaker, implemented on the basis of voice samples of the source speaker and the target speaker; and

- a step (70) for transforming characteristics of the spectral envelope of the voice signal of the source speaker to be converted with the aid of said transformation function,

- a step (60) for determining a fundamental frequency prediction function exclusively according to spectrum-related information for the target speaker, said prediction function being obtained with the aid of an analysis method comprising:

- a step (2) for the analysis of the voice samples grouped together in frames in order to obtain, for each sample frame, spectrum-related information and information relating to the fundamental frequency;

- a step (20) for the determination of a model representing the common characteristics of the spectrum and fundamental frequency of all samples; and

- a step (30) for the determination of a fundamental frequency prediction function exclusively according to spectrum-related information on the basis of said model and voice samples; and

- a step (80) for predicting the fundamental frequency of the voice signal to be converted by applying said fundamental frequency prediction function to said transformed characteristics of the spectral envelope of the voice signal of the source speaker.

19. (currently amended) The method as claimed in claim 3, ~~characterized in that~~ wherein said analysis step (2) is adapted to supply said spectrum-related information in the form of cepstral coefficients.

20. (currently amended) The method as claimed in claim 4, ~~characterized in that~~ wherein said analysis step (2) is adapted to supply said spectrum-related information in the form of cepstral coefficients.